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EXAMINER	
RIDDLE, CHRISTINA A	
ART UNIT	PAPER NUMBER
2882	

NOTIFICATION DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)
	10/589,962	NAGASAKA, HIROYUKI
	Examiner	**Art Unit**
	Christina Riddle	2882

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 November 2010*.
2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.
3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3-12,14-23,26-30 and 40-42* is/are pending in the application.
4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5)☐ Claim(s) _____ is/are allowed.
6)☒ Claim(s) *1, 3-12, 14-23, 26-30, 40-42* is/are rejected.
7)☐ Claim(s) _____ is/are objected to.
8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.
10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a)☐ All b)☐ Some * c)☐ None of:
1.☐ Certified copies of the priority documents have been received.
2.☐ Certified copies of the priority documents have been received in Application No. _____.
3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Status

1. Acknowledgment is made of the amendment filed on 11/16/2010 which amended claims 1, 9, 12, 22, and 27. Claims 1, 3-12, 14-23, 26-30, and 40-42 are currently pending.

Continued Examination Under 37 CFR 1.114

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 11/16/2010 has been entered.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1, 3, 6-12, 14, 19-23, 26, 27, 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ozawa et al. (US Patent No. 5,739,898, Ozawa hereinafter) in view of Fujishima et al. (JP 2000-057436, Fujishima hereinafter; included with Applicant's IDS filed 2/13/2009).

Regarding claim 1, Ozawa discloses an exposure method in which a plurality of times of exposure is performed on a same photosensitive object (Figs. 11, 25, and 37 and col. 38, lines 35-65, wafer W is exposed multiple times) wherein

a substantial wavelength of an exposure light in a space between a projection optical system, which projects said exposure light on said photosensitive object, and said photosensitive object is different in at least one exposure in said plurality of times of exposure from another exposure in said plurality of times of exposure (Fig. 37 and col. 38, lines 35-65, and col. 39, line 55-col. 40, line 10, the exposure wavelength of the exposure apparatus is controlled by the interference filter 3012 to control the exposure wavelength so that the exposure wavelength is different for each exposure during the multiple exposures), and

each of a plurality of areas on said photosensitive object is exposed by said plurality of times of exposure, and after said plurality of areas are exposed by one of said at least one exposure and said another exposure, said plurality of areas are exposed by the other of said at least one exposure and said another exposure (Fig. 37, col. 38, lines 35-65, col. 39, line 55-col. 40, line 41, the patterns on the reticle are transferred to all areas on the wafer to multiply expose the entire wafer using different wavelengths), and

wherein said exposure method is performed using a single exposure apparatus and said same photosensitive object is exposed with one illumination area, between said projection optical system and said photosensitive object, for said at least one exposure and said another exposure of said plurality of times of exposure (Figs. 11, 25, and 37 and col. 39, line 55-col. 40, line 10, a single exposure apparatus projects light between projection optical system 3019 and wafer 3020 to multiply expose the wafer with different wavelengths). However, Ozawa does not appear to explicitly describe wherein a wavelength of said exposure light that enters said space for said at least one exposure is the same as a wavelength of said exposure light that enters said space for said another exposure.

However, Fujishima discloses a substantial wavelength of an exposure light in a space between a projection optical system, which projects said exposure light on said photosensitive object, and said photosensitive object (Figs. 1-4, light illuminates a substrate 5 by passing through a space between projection optical system 2, including auxiliary lens 4 when lens 4 is positioned between projection optical system 2 and substrate 5) is different in at least one exposure from another exposure (Figs. 1-4, and paras. [0007], [0008], [0010], [0011], and [0017], when lens 4 is positioned between projection optical system 2 and substrate 5, liquid L is between the lens 4 and substrate 5, which makes the exposure wavelength different than the state in which no liquid L fills the space between the projection optical system 2 and substrate 5) and a wavelength of said exposure light that enters said space for said at least one exposure is the same as a wavelength of said exposure light that enters said space for said another exposure

(Figs. 1-4, and paras. [0011] and [0017], the wavelength of light that enters projection optical system 2 is the same for when lens 4 and liquid L are used (immersion use) as when the projection exposure apparatus is used in normal use without liquid L).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have included having the wavelength of exposure light that enters the space be the same for both exposures as taught by Fujishima in the plurality of times of exposure in the exposure method of multiply exposing a photosensitive object as taught by Ozawa since having the same wavelength that enters a space between a projection optical system and a photosensitive object in multiple exposures is common in order to control the resolution between the exposures directly in the space between the projection optical system and the wafer so that the projection optical system may be simplified while improving resolution since the components of the projection optical system and illumination system will be exposed to only one wavelength of exposure light.

Regarding claim 3, Ozawa does not appear to explicitly describe wherein in said at least one exposure, said space is in a state filled with a predetermined liquid.

However, Fujishima discloses wherein in said at least one exposure, said space is in a state filled with a predetermined liquid (Fig. 1, paras. [0007] and [0008], wafer 5 can be exposed under a dry exposure or with a liquid in the space between the projection optical system 2 and wafer 5).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the exposure apparatus taught by Ozawa with structures in

the exposure apparatus as taught by Fujishima in order to allow one of the multiple exposures as taught by Ozawa to be an immersion exposure as taught by Fujishima since, as shown by Fujishima, a space is in a state filled with a predetermined liquid in an exposure is common in order to improve pattern resolution and to achieve smaller printed patterns due to changing the numerical aperture of the lithography system (para. [0002]).

Regarding claim 6, Ozawa as modified by Fujishima discloses wherein in said another exposure, said space is in a state not filled with liquid (Ozawa, Fig. 37 and col. 39, line 55-col. 40, line 10, a single exposure apparatus projects light between projection optical system 3019 and wafer 3020 to multiply expose the wafer with different wavelengths in a dry apparatus and Fujishima, Fig. 1, and para. [0007], wafer 4 is exposed in a normal, dry exposure method).

Regarding claim 7, Ozawa as modified by Fujishima discloses wherein said at least one exposure is performed prior to said another exposure (Ozawa, Fig. 37 and col. 38, lines 35-65, and col. 39, line 55-col. 40, line 21, multiple exposure is performed so that the exposure wavelength of light between the projection optical system 3019 and wafer 3020 is adjusted to either the first or second wavelength depending on which exposure is occurring and has occurred).

Regarding claim 8, Ozawa as modified by Fujishima discloses wherein said at least one exposure is performed after said another exposure is performed (Ozawa, Fig. 37 and col. 38, lines 35-65, and col. 39, line 55-col. 40, line 21, multiple exposure is performed so that the exposure wavelength of light between the projection optical

system 3019 and wafer 3020 is adjusted to either the first or second wavelength depending on which exposure is occurring and has occurred).

Regarding claim 9, Ozawa as modified by Fujishima discloses wherein a wavelength of the exposure light that enters said projection optical system in said at least one exposure is different from a wavelength of an exposure light in said third exposure (Ozawa, Fig. 37 and col. 39, line 55-col. 40, line 10, interference filter 3021 selects a first or second wavelength that is made to enter projection optical system 3019 so that a wavelength that enters the projection optical system 3019 is different from the wavelength that enters the system as taught by Fujishima that changes the wavelength between the substrate and projection optical system).

Regarding claim 10, the first embodiment of Ozawa as modified by Fujishima does not appear to explicitly describe wherein in said at least one exposure, a phase shift method is used.

However, the second embodiment of Ozawa discloses wherein in said at least one exposure, a phase shift method is used (col. 12, lines 23-28, col. 13, lines 52-61, and col. 46, lines 57-col. 47, line 10, a phase shift mask is used to improve contrast and resolution).

It would have been obvious to one skilled in the art at the time of the invention to use a phase shift mask as shown by the second embodiment taught by Ozawa in the exposure apparatus changing the exposure wavelength taught by Ozawa as modified by Fujishima since, as shown by Ozawa, a phase shift mask in an exposure apparatus

is commonly used in the art to improve pattern resolution and contrast (col. 12, lines 23-28).

Regarding claim 11, Ozawa as modified by Fujishima discloses a device manufacturing method including a lithography process (Ozawa, col. 1, lines 10-14, semiconductor devices are produced using a lithography process) wherein

the exposure method of claim 1 is performed to expose a photosensitive object a plurality of times (Ozawa, Fig. 37, col. 38, lines 35-65, col. 39, line 55-col. 40, line 41, the patterns on the reticle are transferred to all areas on the wafer to multiply expose the entire wafer using different wavelengths).

Regarding claim 12, Ozawa discloses an exposure method in which a plurality of times of exposure is performed on a same photosensitive object (Figs. 11, 25, and 37 and col. 38, lines 35-65, wafer W is exposed multiple times), said method comprising:

exposing, under a first exposure condition where a substantial wavelength of an exposure light in a space between an optical member and said photosensitive object is a first wavelength, said photosensitive object by said exposure light of said first wavelength (Fig. 37 and col. 38, lines 35-65, and col. 39, line 55-col. 40, line 21, interference filter 3012 selects the exposure wavelength of light so that the wavelength of light between the projection optical system 3019 and wafer 3020 is adjusted to the first wavelength); and

exposing, under a second exposure condition where a substantial wavelength of said exposure light in a space between said optical member and said photosensitive object is a second wavelength different from said first wavelength, said photosensitive

object by said exposure light of said second wavelength (Fig. 37 and col. 38, lines 35-65, and col. 39, line 55-col. 40, line 21, interference filter 3012 selects the exposure wavelength of light so that the wavelength of light between the projection optical system 3019 and wafer 3020 is adjusted to the second wavelength), wherein

each of a plurality of areas on said photosensitive object is exposed by said plurality of times of exposure, and after said plurality of areas are exposed by one of the exposure under said first exposure condition and the exposure under said second exposure condition, said plurality of areas are exposed by the other of the exposure under said first exposure condition and the exposure under said second exposure condition (Fig. 37, col. 38, lines 35-65, col. 39, line 55-col. 40, line 41, the patterns on the reticle are transferred to all areas on the wafer to multiply expose the entire wafer using different wavelengths), and

said exposure under said first exposure condition and said exposure under said second exposure condition are severally executed in a same exposure apparatus with one illumination area between said optical member and said photosensitive object (Figs. 11, 25, and 37 and col. 39, line 55-col. 40, line 10, a single exposure apparatus projects light between projection optical system 3019 and wafer 3020 to multiply expose the wafer with different wavelengths). However, Ozawa does not appear to explicitly describe a wavelength of said exposure that enters said space under said first exposure condition is the same as a wavelength of said exposure light that enters said space under said second exposure condition.

However, Fujishima discloses a substantial wavelength of an exposure light in a space between an optical member and said photosensitive object is a first wavelength (Figs. 1-4, light illuminates a substrate 5 by passing through a space between projection optical system 2, including auxiliary lens 4 when lens 4 is positioned between projection optical system 2 and substrate 5) is different in at least one exposure from another exposure (Figs. 1-4, and paras. [0007], [0008], [0010], [0011], and [0017], when lens 4 is positioned between projection optical system 2 and substrate 5, liquid L is between the lens 4 and substrate 5, which makes the exposure wavelength different than the state in which no liquid L fills the space between the projection optical system 2 and substrate 5) and a wavelength of said exposure light that enters said space under said first exposure condition is the same as a wavelength of said exposure light that enters said space under said second exposure condition (Figs. 1-4, and paras. [0011] and [0017], the wavelength of light that enters projection optical system 2 is the same for when lens 4 and liquid L are used (immersion use) as when the projection exposure apparatus is used in normal use without liquid L).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have included having the wavelength of exposure light that enters the space be the same for both exposures as taught by Fujishima in the plurality of times of exposure in the exposure method of multiply exposing a photosensitive object as taught by Ozawa since having the same wavelength that enters a space between a projection optical system and a photosensitive object in multiple exposures is common in order to control the resolution between the exposures directly in the space between the

projection optical system and the wafer so that the projection optical system may be simplified while improving resolution since the components of the projection optical system and illumination system will be exposed to only one wavelength of exposure light.

Regarding claim 14, Ozawa does not appear to explicitly describe wherein said exposure under said first exposure condition is an immersion exposure performed in a state where said space is filled with a predetermined liquid.

However, Fujishima discloses wherein said exposure under said first exposure condition is an immersion exposure performed in a state where said space is filled with a predetermined liquid (Fig. 1, paras. [0007] and [0008], wafer 5 can be exposed under a dry exposure or with a liquid in the space between the projection optical system 2 and wafer 5).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the exposure apparatus taught by Ozawa with structures in the exposure apparatus as taught by Fujishima in order to allow one of the multiple exposures as taught by Ozawa to be an immersion exposure as taught by Fujishima since, as shown by Fujishima, a space is in a state filled with a predetermined liquid in an exposure is common in order to improve pattern resolution and to achieve smaller printed patterns due to changing the numerical aperture of the lithography system (para. [0002]).

Regarding claim 19, Ozawa as modified by Fujishima discloses wherein in said another exposure under said second exposure condition is a dry exposure performed in

a state where said space is not filled with liquid (Ozawa, Fig. 37 and col. 39, line 55-col. 40, line 10, a single exposure apparatus projects light between projection optical system 3019 and wafer 3020 to multiply expose the wafer with different wavelengths in a dry apparatus and Fujishima, Fig. 1, and para. [0007], wafer 4 is exposed in a normal, dry exposure method).

Regarding claim 20, Ozawa as modified by Fujishima discloses wherein said exposure under said first exposure condition is performed prior to said exposure under said second condition (Ozawa, Fig. 37 and col. 38, lines 35-65, and col. 39, line 55-col. 40, line 21, multiple exposure is performed so that the exposure wavelength of light between the projection optical system 3019 and wafer 3020 is adjusted to either the first or second wavelength depending on which exposure is occurring and has occurred and as modified by Fujishima, the first exposure is performed under a liquid immersion condition, Fig. 1 and para. [0008]).

Regarding claim 21, Ozawa as modified by Fujishima discloses wherein said exposure under said first condition is performed after said exposure under said second exposure condition has been performed (Ozawa, Fig. 37 and col. 38, lines 35-65, and col. 39, line 55-col. 40, line 21, multiple exposure is performed so that the exposure wavelength of light between the projection optical system 3019 and wafer 3020 is adjusted to either the first or second wavelength depending on which exposure is occurring and has occurred and as modified by Fujishima, the first exposure is performed under a liquid immersion condition, Fig. 1 and para. [0008]).

Regarding claim 22, Ozawa as modified by Fujishima discloses wherein said wavelength of exposure light that enters said optical member in said exposure under said first exposure condition is different from a wavelength of exposure light that enters said optical member in an exposure under a third exposure condition (Ozawa, Fig. 37 and col. 39, line 55-col. 40, line 10, interference filter 3021 selects a first or second wavelength that is made to enter projection optical system 3019 so that a wavelength that enters the projection optical system 3019 is different from the wavelength that enters the system as taught by Fujishima that changes the wavelength between the substrate and projection optical system).

Regarding claim 23, the first embodiment of Ozawa as modified by Fujishima does not appear to explicitly describe wherein in said at least one exposure, a phase shift method is used.

However, the second embodiment of Ozawa discloses wherein in said at least one exposure, a phase shift method is used (col. 12, lines 23-28, col. 13, lines 52-61, and col. 46, lines 57-col. 47, line 10, a phase shift mask is used to improve contrast and resolution).

It would have been obvious to one skilled in the art at the time of the invention to use a phase shift mask as shown by the second embodiment taught by Ozawa in the exposure apparatus changing the exposure wavelength taught by Ozawa as modified by Fujishima since, as shown by Ozawa, a phase shift mask in an exposure apparatus is commonly used in the art to improve pattern resolution and contrast (col. 12, lines 23-28).

Regarding claim 26, Ozawa as modified by Fujishima discloses a device manufacturing method including a lithography process (Ozawa, col. 1, lines 10-14, semiconductor devices are produced using a lithography process) wherein

the exposure method of claim 12 is performed to expose a photosensitive object a plurality of times (Ozawa, Fig. 37, col. 38, lines 35-65, col. 39, line 55-col. 40, line 41, the patterns on the reticle are transferred to all areas on the wafer to multiply expose the entire wafer using different wavelengths).

Regarding claim 27, Ozawa discloses an exposure apparatus (Figs. 11, 25, and 37) that performs a plurality of times of exposure on a same photosensitive object (Figs. 11, 25, and 37 and col. 38, lines 35-65, wafer W is exposed multiple times), said apparatus comprising:

a stage that holds said photosensitive object (Fig. 11, movable stage 230 supports wafer 190 or Fig. 25, wafer stage WST supports wafer W);

a projection optical system that projects an exposure light on said photosensitive object (Fig. 37, projection optical system 3019 projects light from photomask 3018 onto wafer 3020);

an adjustment unit (interference filter 3012, Fig. 37) that adjusts a substantial wavelength of said exposure light in a space between said projection optical system and said photosensitive object (Fig. 37 and col. 38, lines 35-65, and col. 39, line 55-col. 40, line 21, interference filter 3012 selects the exposure wavelength of light so that the wavelength of light between the projection optical system 3019 and wafer 3020 is adjusted); and

a control unit (Figs. 25 and 37 and col. 39, line 55-col. 40, line 21, a main control system 1023) that controls said adjustment unit when exposing said photosensitive object a plurality of times so that in at least one exposure of said plurality of times, said substantial wavelength of said exposure light in said space is different from the substantial wavelength in another exposure (Figs. 25 and 37 and col. 29, lines 6-8, col. 38, lines 35-65, and col. 39, line 55-col. 40, line 10, main control system 1023 of an exposure apparatus controls operations of the entire apparatus, including controlling the interference filter 3012 to control the exposure wavelength so that the exposure wavelength is different for each exposure during the multiple exposures),

wherein the exposure apparatus is a single exposure apparatus and said same photosensitive object is exposed with one illumination area, between said projection optical system and said same photosensitive object, for said at least one exposure and said another exposure (Figs. 11, 25, and 37 and col. 39, line 55-col. 40, line 10, a single exposure apparatus projects light between projection optical system 3019 and wafer 3020 to multiply expose the wafer with different wavelengths). However, Ozawa discloses wherein a wavelength of said exposure light that enters said space is a same wavelength for said at least one exposure and for said another exposure, and said adjustment unit adjusts the substantial wavelength after the exposure light enters said space.

However, Fujishima discloses an adjustment unit that adjusts a substantial wavelength of said exposure light in a space between said projection optical system and said photosensitive object (Figs. 1-4, light illuminates a substrate 5 by passing through a

space between projection optical system 2, including auxiliary lens 4 when lens 4 is positioned between projection optical system 2 and substrate 5 by lens holder 3 and rotary shaft 7) and wherein a substantial wavelength of an exposure light in a space between the projection optical system and said photosensitive object is different from the substantial wavelength in another exposure (Figs. 1-4, and paras. [0007], [0008], [0010], [0011], and [0017], when lens 4 is positioned between projection optical system 2 and substrate 5, liquid L is between the lens 4 and substrate 5, which makes the exposure wavelength different than the state in which no liquid L fills the space between the projection optical system 2 and substrate 5) and wherein a wavelength of said exposure light that enters said space is a same wavelength for said at least one exposure and for another exposure, and said adjustment unit adjusts the substantial wavelength after the exposure light enters said space (Figs. 1-4, and paras. [0011] and [0017], the wavelength of light that enters projection optical system 2 is the same for when lens 4 and liquid L are used (immersion use) as when the projection exposure apparatus is used in normal use without liquid L and lens holder 3 and rotary shaft 7 are used to rotate lens 4 in and out of the path of the exposure light).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have included having the wavelength of exposure light that enters the space be the same for both exposures as taught by Fujishima with the plurality of times of exposure in the exposure apparatus that performs multiply exposure of a photosensitive object as taught by Ozawa since having the same wavelength that enters a space between a projection optical system and a photosensitive object in

multiple exposures is common in order to control the resolution between the exposures directly in the space between the projection optical system and the wafer so that the projection optical system may be simplified while improving resolution since the components of the projection optical system and illumination system will be exposed to only one wavelength of exposure light.

Regarding claim 30, Ozawa as modified by Fujishima discloses a device manufacturing method including a lithography process (Ozawa, col. 1, lines 10-14, semiconductor devices are produced using a lithography process) comprising

transferring a device pattern onto a photosensitive object by using the exposure apparatus according to Claim 27 (Ozawa, Figs. 25 and 37, a pattern on a reticle 3018 is transferred onto wafer 3020), and

performing further lithography processing (Ozawa, Figs. 25 and 37 and col. 29, lines 6-8, col. 38, lines 35-65, and col. 39, line 55-col. 40, line 10 and col. 60, lines 8-19, the wafer is multiple exposed to a pattern on a reticle by controlling the interference filter 3012 to control the exposure wavelength so that the exposure wavelength is different for each exposure during the multiple exposures and further processing is performed to form a semiconductor device).

Regarding claims 40-42, Ozawa as modified by Fujishima discloses wherein throughout said plurality of times of exposure, said photosensitive object is exposed with said one illumination area (Ozawa, Fig. 37, col. 39, line 55-col. 40, line 10, a single exposure apparatus projects light between projection optical system 3019 and wafer

3020 to multiply expose the wafer with different wavelengths using one projection optical system 3019).

5. Claims 4, 5, 15-18, 28, and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ozawa as modified by Fujishima as applied to claims 3, 14, and 27 above, and further in view of Kudo (JP 10-340846, included in Applicant's IDS filed 11/30/2006).

Regarding claim 4, although Ozawa as modified by Fujishima discloses multiple exposure of a substrate (Figs. 25 and 37 and col. 29, lines 6-8, col. 38, lines 35-65, and col. 39, line 55-col. 40, line 10, main control system 1023 of an exposure apparatus controls operations of the entire apparatus, including controlling the interference filter 3012 to control the exposure wavelength so that the exposure wavelength is different for each exposure during the multiple exposures), Ozawa as modified by Fujishima does not appear to explicitly describe wherein in said another exposure, said space is in a state filled with another liquid that has a refractive index smaller than a refractive index of said predetermined liquid.

Kudo discloses said space is in a state filled with another liquid that has a refractive index smaller than a refractive index of said predetermined liquid ([0033], the refractive index of the liquid is decreased by adding less ethyl alcohol).

It would have been obvious to one skilled in the art at the time of the invention to have included liquid with a lower index of refraction than another liquid as taught by Kudo in the multiple exposure method taught by Ozawa as modified by Fujishima since

an immersion fluid with different refractivity is commonly used to allow improved control of numerical aperture for different process conditions, thereby allowing better control of imaging performance.

Regarding claim 5, although Ozawa as modified by Fujishima discloses multiple exposure of a substrate (Figs. 25 and 37 and col. 29, lines 6-8, col. 38, lines 35-65, and col. 39, line 55-col. 40, line 10, main control system 1023 of an exposure apparatus controls operations of the entire apparatus, including controlling the interference filter 3012 to control the exposure wavelength so that the exposure wavelength is different for each exposure during the multiple exposures), Ozawa as modified by Fujishima does not appear to explicitly describe wherein in said another exposure, said space is in a state filled with another liquid that has solubility to a specific material contained within a photosensitive agent of said photosensitive object lower than said predetermined liquid.

However, Kudo discloses wherein said space is filled with another liquid that has solubility to a specific material contained within a photosensitive agent of said photosensitive object lower than said predetermined liquid (paragraph labeled [A 2nd embodiment], between paragraphs [0029] and [0030], ethyl alcohol is used as an additive to water to avoid dissolving the photosensitive agent on the surface of the photosensitive object).

It would have been obvious to one skilled in the art at the time of the invention to have included a liquid with a lower solubility to material in photosensitive agent than another liquid as taught by Kudo, in the multiple exposure method taught by Ozawa as

modified by Fujishima since, as suggested by Kudo, an immersion fluid with a lower solubility to a photosensitive agent is commonly used to prevent dissolution of the photosensitive layer of resist on the surface of the photosensitive object (paragraph labeled [Second Embodiment]).

Regarding claim 15, Ozawa as modified by Fujishima discloses performing multiple exposure (Ozawa, Figs. 25 and 37 and col. 29, lines 6-8, col. 38, lines 35-65, and col. 39, line 55-col. 40, line 10, main control system 1023 of an exposure apparatus controls operations of the entire apparatus, including controlling the interference filter 3012 to control the exposure wavelength so that the exposure wavelength is different for each exposure during the multiple exposures), Ozawa as modified by Fujishima does not appear to explicitly describe wherein said exposure under said second exposure condition is an immersion exposure performed in a state where said space is filled with another liquid that has a refractive index different from a refractive index of said predetermined liquid.

However, Kudo discloses wherein said space is filled with another liquid that has a refractive index different from a refractive index of said predetermined liquid (paragraph [0030], a liquid additive of a different type, and thus a different refractive index, fills the space, and [0033], the refractive index of the liquid is decreased by adding less ethyl alcohol).

It would have been obvious to one skilled in the art at the time of the invention to have included liquid with a different index of refraction than another liquid as taught by Kudo in the multiple exposure method taught by Ozawa as modified by Fujishima since

an immersion fluid with different controllable refractivity is commonly used to allow improved control of numerical aperture for different process conditions.

Regarding claim 16, Ozawa as modified by Fujishima in view of Kudo discloses wherein said predetermined liquid has a refractive index larger than the refractive index of said another liquid (Kudo, [0033], the refractive index of the liquid is decreased by adding less ethyl alcohol).

Regarding claim 17, Ozawa as modified by Fujishima discloses multiple exposure of a substrate (Figs. 25 and 37 and col. 29, lines 6-8, col. 38, lines 35-65, and col. 39, line 55-col. 40, line 10, main control system 1023 of an exposure apparatus controls operations of the entire apparatus, including controlling the interference filter 3012 to control the exposure wavelength so that the exposure wavelength is different for each exposure during the multiple exposures), Ozawa as modified by Fujishima does not appear to explicitly describe wherein said exposure under said second exposure condition is an immersion exposure performed in a state where said space is filled with another liquid that has solubility to a specific material contained within a photosensitive agent of said photosensitive object different from said predetermined liquid.

However, Kudo discloses wherein said second exposure condition is an immersion exposure performed in a state where said space is filled with another liquid that has solubility to a specific material contained within a photosensitive agent of said photosensitive object different and smaller than said predetermined liquid (paragraph labeled [A 2nd embodiment], between paragraphs [0029] and [0030], ethyl alcohol is

used as an additive to water to avoid dissolving the photosensitive agent on the surface of the photosensitive object).

It would have been obvious to one skilled in the art at the time of the invention to have included a liquid with a lower solubility to material in photosensitive agent than another liquid as taught by Kudo, in the multiple exposure method taught by Ozawa as modified by Fujishima since, as suggested by Kudo, an immersion fluid with a lower solubility to a photosensitive agent is commonly used to prevent dissolution of the photosensitive layer of resist on the surface of the photosensitive object (paragraph labeled [Second Embodiment]).

Regarding claim 18, Ozawa as modified by Fujishima in view of Kudo discloses wherein said another liquid has solubility to said specific material contained within said photosensitive agent of said photosensitive object smaller than said predetermined liquid (Kudo, paragraph labeled [A 2nd embodiment], between paragraphs [0029] and [0030], ethyl alcohol is used as an additive to water to avoid dissolving the photosensitive agent on the surface of the photosensitive object).

Regarding claim 28, although Ozawa discloses in another exposure, no liquid is supplied to said space (Fig. 37 and col. 39, line 55-col. 40, line 10, a single exposure apparatus projects light between projection optical system 3019 and wafer 3020 to multiply expose the wafer with different wavelengths in a dry apparatus), Ozawa does not appear to explicitly describe wherein said adjustment unit comprises a liquid supply mechanism that supplies a predetermined liquid so that in a space between said projection optical system and said stage, at least a space between said projection

optical system and said photosensitive object on said stage is filled with said liquid, whereby said control unit controls adjustment unit so that said liquid supply mechanism supplies said liquid to said space between said projection optical system and said photosensitive object on said stage in said at least one exposure.

However, Fujishima discloses wherein in said at least one exposure, said space is in a state filled with a predetermined liquid (Fig. 1, paras. [0007] and [0008], wafer 5 can be exposed under a dry exposure or with a liquid in the space between the projection optical system 2 and wafer 5) and wherein in said one exposure the liquid supply mechanism does not supply liquid to said space (Fig. 1, paras. [0007] and [0008], wafer 5 can be exposed under a dry exposure or with a liquid in the space between the projection optical system 2 and wafer 5).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the exposure apparatus taught by Ozawa with structures in the exposure apparatus as taught by Fujishima in order to allow one of the multiple exposures as taught by Ozawa to be an immersion exposure as taught by Fujishima since, as shown by Fujishima, a space is in a state filled with a predetermined liquid in an exposure is common in order to improve pattern resolution and to achieve smaller printed patterns due to changing the numerical aperture of the lithography system (para. [0002]).

However, Ozawa as modified by Fujishima does not appear to explicitly describe wherein said adjustment unit comprises a liquid supply mechanism that supplies a predetermined liquid so that in a space between said projection optical system and said

stage, at least a space between said projection optical system and said photosensitive object on said stage is filled with said liquid, whereby said control unit controls adjustment unit so that said liquid supply mechanism supplies said liquid to said space between said projection optical system and said photosensitive object on said stage in said at least one exposure.

However, Kudo discloses said adjustment unit comprises a liquid supply mechanism (Fig. 3 and paragraphs [0030]-[0031], liquid supply mechanism, supply pipes LS and LQ and valves DVLS, DVLWS, and DVL, supply a predetermined liquid to the space) that supplies a predetermined liquid so that in a space between said projection optical system and said stage, at least a space between said projection optical system and said photosensitive object on said stage is filled with said liquid (Fig. 3 and paragraphs [0030]-[0031], liquid supply mechanism, supply pipes LS, LQ, and exhaust pipe L in addition to valves DVLS, DVLWS, and DVL can supply and control the flow of ethyl alcohol, water, and a mixture of ethyl alcohol and water, supply a predetermined liquid to the space),

whereby said control unit (Fig. 3 and para. [0031], control unit CPU 2) controls said adjustment unit so that said liquid supply mechanism supplies said liquid to said space between said projection optical system and said photosensitive object on said stage in said at least one exposure (Kudo Fig. 3 and paragraph [0031], control unit, CPU 2, controls the operation of the adjustment unit (pipes and valves) to adjust the index of refraction and thereby, the wavelength).

It would have been obvious to one skilled in the art at the time of the invention to have included a liquid supply mechanism that supplies a liquid to the space and a control unit that controls the adjustment unit to control the liquid supply mechanism as taught by Kudo in the exposure apparatus taught by Ozawa as modified by Fujishima since supplying a liquid with a wavelength adjustment and control unit in an exposure apparatus is commonly used in the art to improve pattern resolution and to increase the numerical aperture to the exposure apparatus in order to pattern smaller feature sizes.

Regarding claim 29, Ozawa does not appear to explicitly describe wherein said adjustment unit comprises a liquid supply mechanism that supplies any one liquid of a plurality of types of liquid so that in a space between said projection optical system and said stage, at least a space between said projection optical system and said photosensitive object on said stage is filled with said liquid, whereby

said control unit controls said adjustment unit so that said liquid supply mechanism supplies a predetermined liquid of said plurality of types of liquid to said space between said projection optical system and said photosensitive object on said stage in said at least one exposure, whereas in said another exposure said liquid supply mechanism supplies a liquid different from said predetermined liquid to said space.

However, Fujishima discloses wherein in said at least one exposure, said space is in a state filled with a predetermined liquid (Fig. 1, paras. [0007] and [0008], wafer 5 can be exposed under a dry exposure or with a liquid in the space between the projection optical system 2 and wafer 5).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the exposure apparatus taught by Ozawa with structures in the exposure apparatus as taught by Fujishima in order to allow one of the multiple exposures as taught by Ozawa to be an immersion exposure as taught by Fujishima since, as shown by Fujishima, a space is in a state filled with a predetermined liquid in an exposure is common in order to improve pattern resolution and to achieve smaller printed patterns due to changing the numerical aperture of the lithography system (para. [0002]).

However, Ozawa as modified by Fujishima does not appear to explicitly describe wherein said adjustment unit comprises a liquid supply mechanism that supplies any one liquid of a plurality of types of liquid so that in a space between said projection optical system and said stage, at least a space between said projection optical system and said photosensitive object on said stage is filled with said liquid, whereby

said control unit controls said adjustment unit so that said liquid supply mechanism supplies a predetermined liquid of said plurality of types of liquid to said space between said projection optical system and said photosensitive object on said stage in said at least one exposure, whereas in said another exposure said liquid supply mechanism supplies a liquid different from said predetermined liquid to said space.

However, Kudo discloses said adjustment unit comprises a liquid supply mechanism that supplies any one liquid of a plurality of types of liquid so that in a space between said projection optical system and said stage, at least a space between said projection optical system and said photosensitive object on said stage is filled with said

liquid (Fig. 3 and paragraphs [0030]-[0031], liquid supply mechanism, supply pipes LS, LQ, and exhaust pipe L in addition to valves DVLS, DVLWS, and DVL can supply and control the flow of ethyl alcohol, water, and a mixture of ethyl alcohol and water, supply a predetermined liquid to the space), whereby said control unit controls said adjustment unit so that said liquid supply mechanism supplies a predetermined liquid of said plurality of types of liquid to said space between said projection optical system and said photosensitive object on said stage in said at least one exposure, whereas in said another exposure said liquid supply mechanism supplies a liquid different from said predetermined liquid to said space (Fig. 3 and paragraph [0031], control unit, CPU 2, controls the operation of the adjustment unit (pipes and valves) to adjust the index of refraction by changing the supply of the additive and thereby, changing the wavelength).

It would have been obvious to one skilled in the art at the time of the invention to include a liquid supply mechanism that supplies a plurality of types of liquid to the space as taught by Kudo in the exposure apparatus taught by Ozawa as modified by Fujishima since supplying a variety of liquids in a wavelength adjustment and control unit is commonly used in the art to correct shifts in wavelength emitted by the laser that occur over time in order to maintain correct equipment operation, while ensuring that the liquids used in the immersion space do not adversely effect imaging due to interaction with the surface of the photosensitive film on the object to be exposed.

Response to Arguments

6. Applicant's arguments with respect to claims 1, 3-12, 14-23, 26-30, and 40-42 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christina Riddle whose telephone number is (571)270-7538. The examiner can normally be reached on Monday- Thursday 7:00-17:30 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Glick can be reached on (571)272-2490. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Peter B. Kim/
Primary Examiner, Art Unit 2882

/C. R./
Examiner, Art Unit 2882